When should an FNA be performed using ultrasound guidance?

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Review

- US-FNA useful in combined evaluation of thyroid nodule
  - Characterization of nodule
    - Size, solid, cystic, well-circumscribed, irregular, calcifications, vascularity
  - Accurate placement of needle into nodule
  - Detailed examination of remainder of thyroid

Methods

- Systematic literature review using evidence-based criteria
- Medline search of English-language papers
  - Keywords covered thyroid nodules, FNA cytology, and ultrasound guidance

Methods

- Excluded
  - Review articles and commentaries
  - Earlier reports published as a more comprehensive report
  - Reports before 1995
- Reports assigned levels of evidence
  - Sackett's classification[1] modified by Heinrich[2]

1. Sackett DL. *Chest.* 1989;95:2S-4S.
2. Heinrich S, et al. *Ann Surg.* 2006;243:154-168.

Classification System

Level of Evidence	Type of Trial	Criteria for Classification
I	Large randomized trials with clear-cut results (and low risk for error)	Sample size calculation provided and fulfilled, study endpoint provided
II	Small randomized trials with uncertain results (and moderate to high risk for errors)	Matched analysis, sample size calculation not given or not fulfilled; study endpoint not provided, convincing comparative studies
III	Nonrandomized, contemporaneous controls	Noncomparative, prospective
IV	Nonrandomized, historical controls	Retrospective analysis, cohort studies
V	No control, case series only; opinion of experts	Small series, review articles

Best Evidence

1. Court-Payen M, Nygaard B, Horn T, et al. US-guided fine-needle aspiration biopsy of thyroid nodules. *Acta Radiol.* 2002;43(2):131-140.
2. Accurso A, Rocco N, Palumbo A, et al. Usefulness of ultrasound-guided fine-needle aspiration cytology in the diagnosis of non-palpable small thyroid nodules. *Tumori.* 2005;91(4):355-357.
3. Cesur M, Corapcioglu D, Bulut S, et al. Comparison of palpation-guided fine-needle aspiration biopsy to ultrasound-guided fine-needle aspiration biopsy in the evaluation of thyroid nodules. *Thyroid.* 2006;16(6):555-561.
4. Carmeci C, Jeffrey RB, McDougall IR, et al. Ultrasound-guided fine-needle aspiration biopsy of thyroid masses. *Thyroid.* 1998;8(4):283-289.
5. Danese D, Sciacchitano S, Farsetti A, et al. Diagnostic accuracy of conventional versus sonography-guided fine-needle aspiration biopsy of thyroid nodules. *Thyroid.* 1998;8(1):15-21.
6. Hatada T, Okada K, Ishii H, et al. Evaluation of ultrasound-guided fine-needle aspiration biopsy for thyroid nodules. *Am J Surg.* 1998;175(2):133-136.
7. Yokozawa T, Miyauchi A, Kuma K, et al. Accurate and simple method of diagnosing thyroid nodules the modified technique of ultrasound-guided fine needle aspiration biopsy. *Thyroid.* 1995;5(2):141-145.
8. Yokozawa T, Fukata S, Kuma K, et al. Thyroid cancer detected by ultrasound-guided fine-needle aspiration biopsy. *World J Surg.* 1996;20(7):848-853; discussion 853.
9. Koike E, Yamashita H, Noguchi S, et al. Effect of combining ultrasonography and ultrasound-guided fine-needle aspiration biopsy findings for the diagnosis of thyroid nodules. *Eur J Surg.* 2001;167(9):656-661.
10. Deandrea M, Mormile A, Veglio M, et al. Fine-needle aspiration biopsy of the thyroid: comparison between thyroid palpation and ultrasonography. *Endocr Pract.* 2002;8(4):282-286.
11. Papini E, Guglielmi R, Bianchini A, et al. Risk of malignancy in nonpalpable thyroid nodules: predictive value of ultrasound and color-Doppler features. *J Clin Endocrinol Metab.* 2002;87(5):1941-1946.

Evidence

- Best available is 11 reports of Level III or Level III / IV data
  - Sufficiency
  - Sensitivity
  - Re-evaluation
  - Ultrasound-Specific Findings

Sufficiency

Level of Evidence	Reference	Year	Palpation-guided	Ultrasound-guided	Inadequate Specimens with Palpation	Inadequate Specimens with Ultrasound	Comments
III	[1] Court-Payen et al.	2002	NA	342	NA	56 (16%)	82 complex nodules with 2 passes (solid and cystic). Inadequacy rate higher for cystic areas (80% vs. 46%).
III	[2] Accurso et al.	2005	NA	325	NA	72 (22%)	Stratified 3 groups by nodule size and found no difference in percentage of unsatisfactory material.
III	[3] Cesur et al.	2006	285	285	92 (32%)	61 (21%)	All patients underwent both US-FNA and p-FNA. Rate of inadequate material with p-FNA significantly higher only for smaller nodules 10-15 mm (37.6% vs. 24.2%).
III / IV	[4] Carmeci et al.	1998	370	127	60 (16%)	9 (7%)	14 patients had US-FNA due to nondiagnostic p-FNA.
III / IV	[5] Danese et al.	1998	4986	4697	433 (9%)	167 (4%)	No overlap between US-FNA and p-FNA groups.
III / IV	[6] Hatada et al.	1998	94	72	28 (30%)	12 (17%)	No overlap between US-FNA and p-FNA groups.

- Ultrasound guidance likely decreases rate of inadequate specimens

Sensitivity

Level of Evidence	Reference	Year	Palpation-guided	Ultrasound-guided	Sensitivity with Palpation FNA	Sensitivity with Ultrasound FNA	Comments
III	[3] Cesur et al.	2006	285	285	57%	86%	All patients routinely underwent both US-FNA and p-FNA.
III / IV	[5] Danese et al.	1998	4986	4697	92%	97%	No overlap between US-FNA and p-FNA groups.
III / IV	[6] Hatada et al.	1998	94	72	45%	62%	No overlap between US-FNA and p-FNA groups.

- US-FNA appears more sensitive than p-FNA

Re-evaluation

Level of Evidence	Reference	Year	Palpation-guided	Ultrasound-guided Re-evaluation	Reclassified as Suspicious or Malignant	Reclassified Nodules Malignant by Histology	Comments
III	[7] Yokozawa et al.	1995	1000	1000	186 (19%)	149 (84%)	All patients had US-FNA due to nondiagnostic p-FNA.
III	[8] Yokozawa et al.	1996	678	678	107 (16%)	99 (93%)	All patients had benign diagnosis by p-FNA and then underwent US-FNA.
III / IV	[4] Carmeci et al.	1998	370	14	3 (21%)	Incomplete histology	14 patients had US-FNA due to nondiagnostic p-FNA.

- Re-evaluation with US-FNA can provide additional information after p-FNA with benign or non-diagnostic results
- Re-evaluation with US-FNA can lead to the reclassification of a substantial portion of patients and can detect more cancers

Ultrasound-Specific Findings

Level of Evidence	Reference	Year	Ultrasound-guided	Ultrasound-Specific Findings	Comments
III	[9] Koike et al.	2001	329	Criteria used for malignancy: ill-defined margin, irregular shape, solid echo structure, heterogeneous internal echo, hypoechoic pattern, calcifications, no perinodular halo, invasion of adjacent organs.	184 patients with suspicious US-FNA also underwent US preoperatively to make a final preoperative diagnosis. Sensitivity 84% with US-FNA alone; increased to 89% when separate US exam added.
III	[10] Deandrea et al.	2002	420	Criteria used for malignancy: blurred perinodular halo, hypoechoic pattern, microcalcifications, intranodular blood flow.	Divided into 3 groups based on palpation: nonpalpable, single palpable nodule, or MNG. All subsequently underwent US and US-FNA. Histology showed 27 malignant nodules: 12 (45%) nonpalpable, 9 (33%) single palpable nodule, and 6 (22%) within a MNG.
III	[11] Papini et al.	2002	494	Three independent risk factors found for malignancy: irregular margins, intranodular vascularity, and microcalcifications.	All patients had nonpalpable nodules and underwent US, color-Doppler, and US-FNA.

- Ultrasound-specific findings can be used to interpret the FNA based on risk and to identify nodules at risk that should be sampled

Online Forum: Round 1

- 3 sets of comments
- Controversy
  - Indications
  - Sufficiency

Online Forum: Round 1

- Indications
  - US-guided FNA should replace palpation-guided FNA except in superficial nodules difficult to image
  - Larger nodules also better handled by US-FNA to direct needle tip
    - Area under capsule
    - Solid areas in mixed cystic nodule
  - Palpable, homogeneous nodules better sampled with palpation alone

Online Forum: Round 1

- Sufficiency
  - US-guided biopsies bloodier leading to diluted cellularity
  - US-guided FNAs yield less diagnostic material than palpation-guided FNAs by experienced person
  - US-guided FNAs often require another biopsy, while palpation-guided FNAs do not

Online Forum: Round 1

- No revision of 1st draft after round 1 comments

Online Forum: Round 2

- No further comments as of 9/24/07

Conclusions

1. Ultrasound guidance for thyroid FNA should be considered as an alternative to palpation guidance because it permits the operator to
   - Be certain that the nodule of interest is aspirated
   - Be sure that a discrete nodule is present before aspiration
   - Avoid passing the needle into critical structures in the neck

Conclusions

2. Ultrasound guidance should be used to aspirate nodules that are not palpable
3. Ultrasound guidance should be used to aspirate nodules that are predominantly (>25%) cystic
4. Ultrasound guidance should be used if a prior aspiration contained insufficient cells/colloid for interpretation (“nondiagnostic” result)

Discussion